Space Weather Technical Forecast

Issued on Monday, 02 May 2022 at 01:15 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Brief lull in risk of R1/R2 radio blackouts, however activity on both eastern and western limbs.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity fell to Low over the past 24 hours, with occasional C-class activity observed by GOES16. The largest flare of the period was a long-period C3.1 at 01/1128UTC. This flare emanated from the vicinity of returning region Ex-2992 over the southeastern limb, and perhaps provides a hint of an upturn in activity into the coming working week. This is after the current brief lull, with the passing of many of the very active northwestern limb groups, namely Ex-2993, Ex-2994 and shortly the plage containing Ex-2996. There were just two surviving front side sunspot regions by the end of the UTC day of Sunday 01 May - AR2999, an Hsx/Alpha, and AR3001, a Hax/Alpha, with both stable and unremarkable. A third small group, AR2997 faded to plage in the northwestern quadrant in the same period.

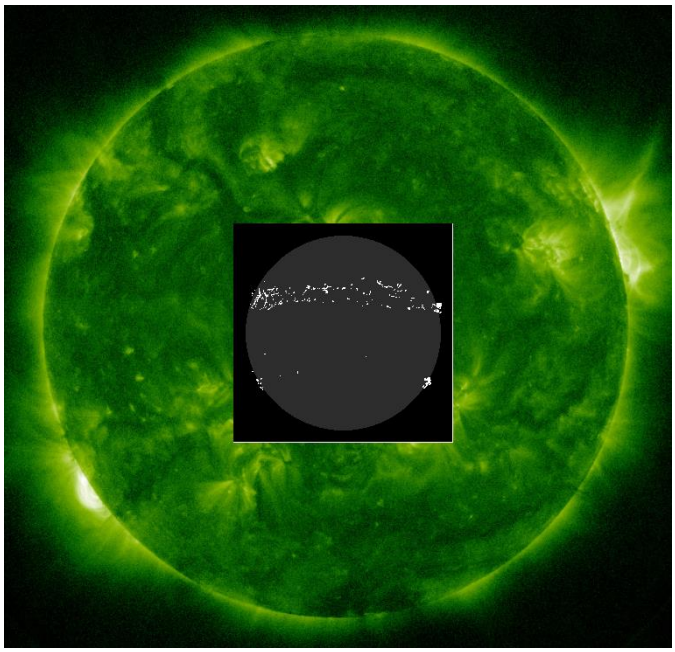

Figure 0: 01/2300UTC AIA094 image showing bright flux regions departing the northwest as a new area arrives in the southeast. Shown inset is X-ray flare activity above C-class in the past fortnight, showing the large contribution made by AR2993, AR2994 and to some extent AR2996. Inset courtesy of SIDC ROB.

Coronagraph imagery for the period was dominated by emissions from both limbs, mainly in the vicinity of the aforementioned northwestern horizon groups, with up to seven separate events visible. At the time of writing none are thought to be Earth-directed, with many firing along similar trajectories to most likely merge. Should thoughts on this change, updates will follow in

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forthcoming guidance.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR at L1, remains characteristic of a negative polarity fast wind (negative phi, towards the sun), with this thought to be tied to coronal hole 78 in the southwestern quadrant. There are now some signs that this feature is starting to wane, with the speed falling from around 500km/s into the high 400s for a time, before undergoing a weak resurgence later in the UTC day to regain lost ground. The solar wind density, meanwhile, remained fairly steady within single figures ppcc, while the IMF showed a 7nT peak, with the north-south component a more modest +/-5nT.

The net result of the above solar wind measures was Quiet to Unsettled geomagnetic activity, provisionally peaking at Kp 3- in the 00-03UTC interval.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) was only very slightly elevated above background, having declined steadily in the wake of the M1.1 flare on 29 April.

The high energy electron flux (greater than 2MeV) showed an increase on the previous day, reaching High flux and 1550pfu at 01/1500UTC. Resulting 24-hour integrated electron fluence has been below the Active threshold (1e8 integrated pfu), but with a rising trend, recording 4.7e7 integrated pfu at 02/0001UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Activity should undergo a decline in the immediate term, with the passing of successive active northwestern limb groups, however there is a chance of some recovery as a further active region likely rotates onto the southeast into the new week.

Solar Wind / Geomagnetic Activity: The current fast wind is the only such feature in the period, and should wane through day one, Monday 02 May. No Coronal Mass Ejections (CMEs) now feature in the forecast.

Occasional Unsettled intervals should decrease in frequency leaving Quiet geomagnetic activity from midweek.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) carries a slightly raised chance of passing S1 at first, due to the presence of numerous active regions narrowly over the western limb, however this risk should reduce to background by midweek.

The high energy electron flux (greater than 2MeV) is likely to spend a greater amount of time within High flux during the first part of this forecast period, in response to CH78's high speed stream, with levels attained on day one, Monday 02 May perhaps remaining similar throughout - in the absence of any further significant geomagnetic activity. The chances of 24-hour integrated electron fluence exceeding Active (1e8 integrated pfu) should therefore soon peak, but most likely remain below threshold.

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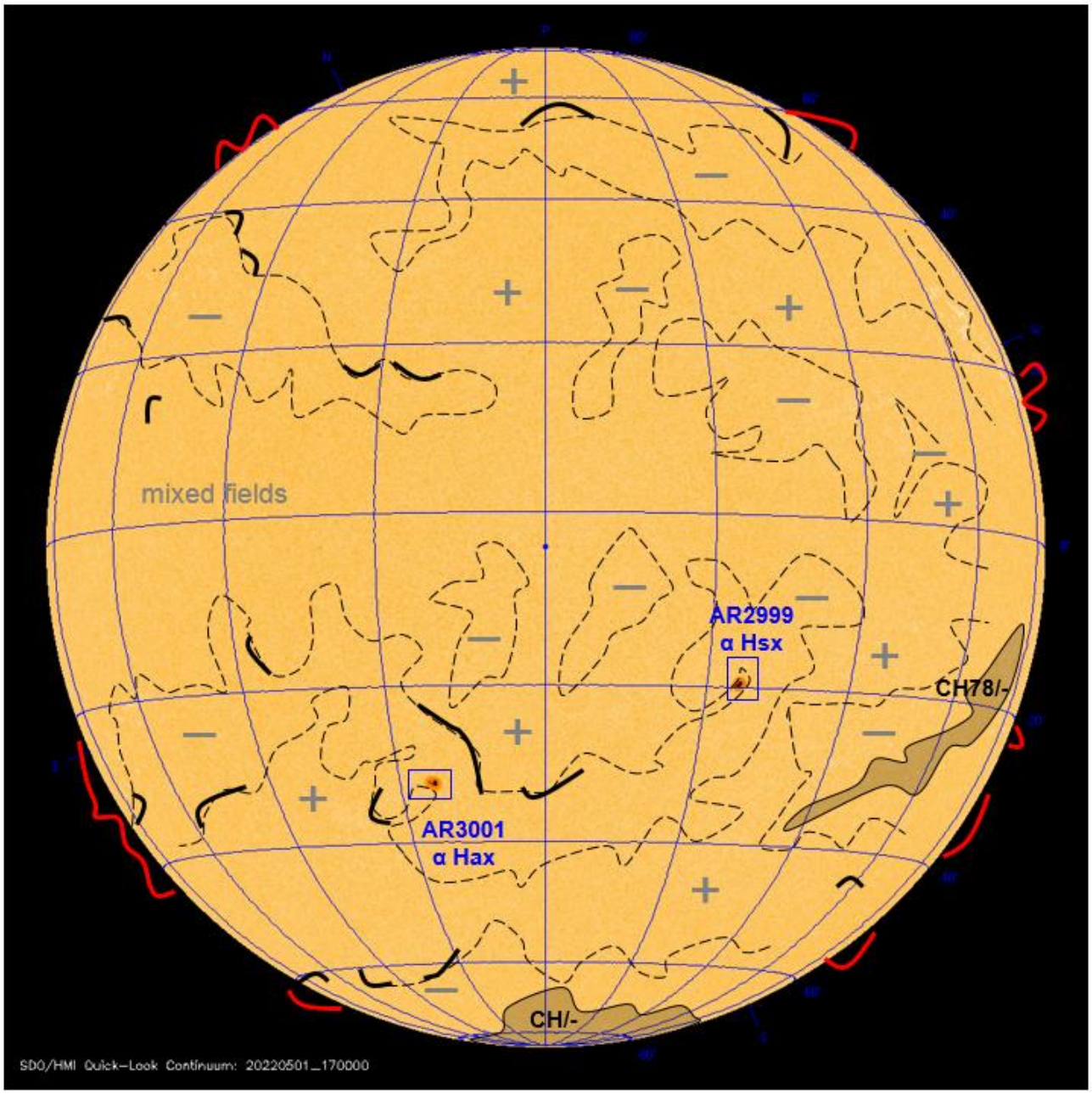
Figure 1. Solar Analysis Valid 01/1700UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

No CMEs feature in this forecast period. A partial halo shock that was previously forecast to potentially affect Earth during 01 May is now considered to have passed, leaving no further transients in the forecast.

The current fast wind enhancement from coronal hole 78 is the only such feature due in the four days, and has long peaked. A gradual waning of this fast wind should continue through day one, Monday 02 May, with fewer Unsettled intervals with time, leaving Quiet conditions from

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midweek.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Radio Blackouts - X-Ray Flares:

Earth is expected to see a brief grace period in the risk of radio blackouts on day one, Monday 02 May, as recent active sunspot regions depart from the northwestern limb, while bright flux looming over the southeastern horizon has yet to arrive.

Any M-class activity is perhaps most likely from the plage containing Ex-2996 at first, being the furthest east of the northwestern limb regions, with the risk later transferring to the arriving Ex-2992 in the southeast, although the degree of any upturn into the new working week remains to be seen once this region shows for analysis. All considered, there is a continued Slight Chance of M-class activity, with a token increase signalled from day two, Tuesday 03 May that may be revised once Ex-2992 fully reveals itself.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	5	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

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Solar Radiation Storms - (High Energy Protons):

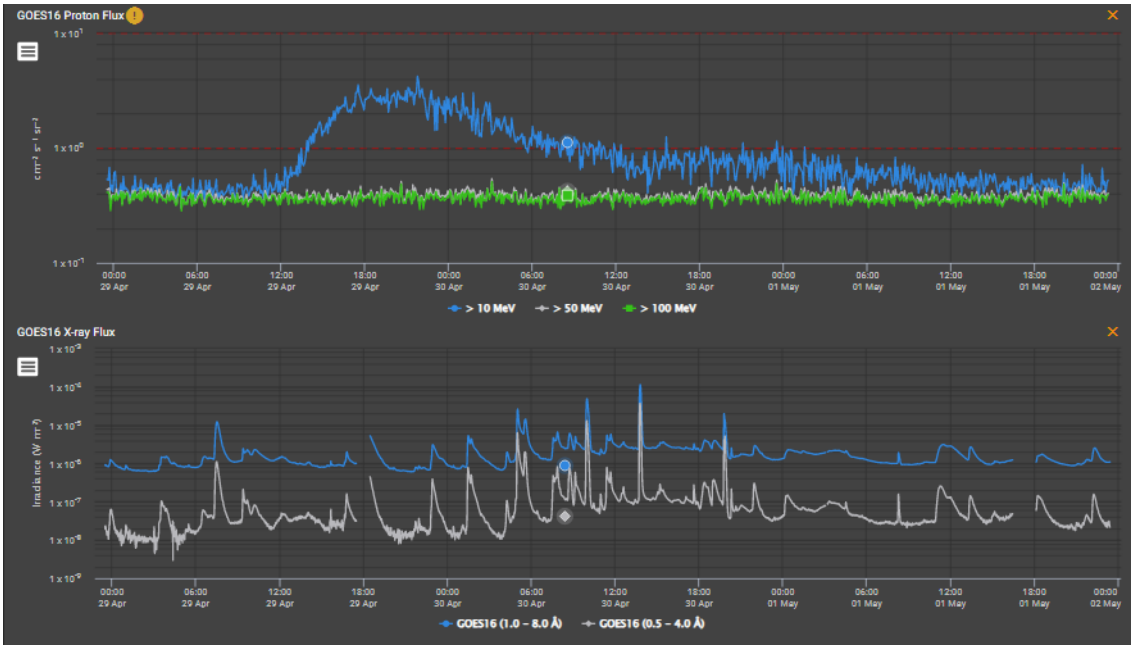
The high energy proton flux (greater than 10 MeV) as measured by GOES-16 at GEO is at background levels, and is most likely to remain so through the next four days.

The presence of Ex-2994, Ex-2993 and the plage from Ex-2996 all lying near the better-connecting western limb at present all serve to slightly increase the risk above background at first, falling to become negligible by day four, Thursday 05 May. Note that none of these regions proved capable of delivering solar radiation storms while on the Earth-facing side, the closest being a 2pfu 10MeV enhancement peaking on 29 April in the wake of Ex-2996's M1 flare of a few hours prior.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	5	2	2	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

Figure 2: Past 72 hours in GOES16 high energy proton flux spectrum, showing gradual decline towards background in the wake of the 2pfu enhancement after the 29 April M1.1 flare.



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High Energy Electrons Event (≥ 2MeV):

The current waning of geomagnetic activity from the current fast wind of CH78 should allow electron flux at GEO to stabilise in the next 24 hours, with levels attained during this period perhaps then persisting for much of the coming four days, perhaps very slightly attenuating later in the week in the slow solar wind that is expected to follow. With no transients now in the forecast to influence this forecast, confidence in REFM should improve, and the current forecast for an initially rising trace then plateauing at sub-Active levels is therefore accepted.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	40	40	40	30
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: Past week in GOES16 high energy electron flux, L1 solar wind speed and 24-hour integrated fluence. Flux and fleunce are likely to increase into the new week, although perhaps most likely fallign short of Active, with any new oscillation pattern soon maturing.

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